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Twenty-first Annual Report

OF THE

SOUTH CAROLINA  
EXPERIMENT  
STATION

*The others are out*

OF THE

Clemson Agricultural College

FOR THE YEAR ENDING

JUNE 30, 1908

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1907-1908.



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THE R. L. BRYAN CO., PRINTERS  
1908



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## BOARD OF EXPERIMENT STATION CONTROL.

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P. H. MELL, Ph. D., LL. D., *President of College.*

## EXPERIMENT STATION STAFF.

J. N. HARPER, B. S., M. Agr., *Director, Agriculture.*

M. B. HARDIN, *Chief Chemist.*

C. C. NEWMAN, *Horticulture.*

C. L. NEWMAN, M. S., *Agriculture.*

F. H. H. CALHOUN, Ph. D., *Geology.*

D. O. NOURSE, B. S., *Animal Husbandry and Dairying.*

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M. R. POWERS, D. V. S., *Veterinary Science.*

A. F. CONRADI, B. Agr., M. S., *Entomology and Zoology.*

R. N. BRACKETT, Ph. D., *Chemistry.*

D. H. HENRY, B. S., *Chemistry.*

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J. H. MITCHELL, M. S., *Chemistry Assistant (Fertilizer Control).*

THOS. E. KEITT, B. S., *Chemistry Assistant (Fertilizer Control).*

C. V. M. CORNELL, B. S., *Chemistry Assistant (Fertilizer Control).*

J. M. BURGESS, B. S., *Herdsmen.*

W. D. GARRISON, B. S., *Foreman of Station Farm.*

MISS HELEN BRADFORD, *Stenographer.*

Mail and telegraph: Clemson, S. C.

Freight and express: Calhoun, S. C.

The Bulletins of the Station are issued at irregular intervals, and are sent free to all citizens of the State who apply for them.

## LETTER OF TRANSMITTAL.

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Clemson College, S. C., November 20, 1908.

Hon. M. F. Ansel, Governor of South Carolina.

Sir: I have the honor to submit herewith the Twenty-first Annual Report of the South Carolina Agricultural Experiment Station, in accordance with the requirements of an Act of Congress, approved March 2, 1887, for the establishment of Agricultural Experiment Stations in connection with the colleges of the several States, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted,

P. H. MELL, President.



## REPORT OF DIRECTOR.

---

Clemson College, S. C., November 26, 1908.

Dr. P. H. Mell, President, Clemson College.

Dear Sir: I have the honor to submit herewith the Twenty-first Annual Report of the South Carolina Experiment Station for the fiscal year ending June 30, 1908:

The work of the Station continues to grow in importance and efficiency, and now that the Station has been separated from the other departments of the College and made into a separate department by a recent act of the Board of Trustees, its usefulness will be greatly extended. It is now the generally accepted opinion of agricultural workers that only a few men can be good investigators and at the same time first class teachers. To work out the many problems confronting the farmer it is necessary to have a corps of workers who will devote their entire energies to these problems and not have their time taken up by routine duties that are imposed upon a teacher. During this fiscal year the officers of the Station were compelled to devote a considerable portion of their time to instructional work in the College, owing to the large number of students taking the agricultural course.

That the work of the Station is being appreciated and more fully understood by the farmers of the State is evidenced by the great number of letters that come to the Station officers from farmers in the State and from other States.

The functions of the Station and the character of the work that it is doing meet fully the demands of the farmers. During the year the Station officers wrote about eight thousand letters to farmers, giving information on a great variety of subjects, and every day's mail brings a great number of requests for the bulletins which have been issued by the Station. A great many of these requests for bulletins cannot be granted because the first editions are exhausted, and a second edition of some of the most popular bulletins has been issued, and even then the demand has been greater than the supply. The farmers of South Carolina are waking up to the opportunities now afforded them by their Agricultural College, their Experiment Station and the work that is being done by the U. S. Department of Agriculture.



This Station continues its experiments to determine the most economical fertilizers to be used on the different soil types found in the State for the various staple crops. Valuable information has been obtained from these experiments. This State is now spending something over \$12,000,000 per year for commercial fertilizers, and it is putting it conservatively to say that at least \$2,000,000 is lost to the farmers of the State by their not knowing the proper proportion of the different ingredients that make up the fertilizers for their different soil types, and by not applying this fertilizer in proper amounts and proportions necessary to the various crops. Our experiments further show that the farmers lose considerable money by applying large amounts of commercial fertilizers, year after year, to cotton without growing their crops in proper rotation. Where crops have been grown in rotation, including legumes, such as cow-peas, bur clover and vetch, more profit is obtained from the commercial fertilizers used.

This Station has continued to grow a great number of varieties of cotton for the purpose of determining the best type of cotton suited to the different soil types of the State and to obtain a variety or strain that is more or less resistant to disease, and also to obtain a variety with a larger boll and a higher yield of lint. Some attention has been paid also to the selection and development of varieties producing a lint of fine quality and length.

The Station is also breeding corn with the view of increasing the yield of grain and also to obtain a smaller, stronger stalk and uniformity in ripening.

Experiments to determine the best time of applying nitrate of soda as a top dressing to cotton have been continued. Our results show that where nitrate of soda is applied at the rate of about 100 lbs. per acre to cotton at the time the plant begins to make its fruit, the yield is increased to a considerable extent. The applications made about July 1st gave the largest yield. The results obtained varied with the amount of humus in the soil, the type of soil, and the moisture conditions at the time of applying.

Experiments to determine the relative value of nitrate of soda and cotton seed meal as the source of nitrogen have led to some interesting results. On poor soils depleted of humus, the first year nitrate of soda, where put on in two applications, gave better results than where cotton seed meal was used; the same amount of nitrogen being used in both cases. The second year, however, the plots receiving the cotton seed meal out-yielded the plots receiving nitrate of soda.



It is the object of the Station to encourage diversified farming, for it is our belief that the one crop system is at the root of most of the evils confronting the Southern farmer. As long as the farmers of the South continue to plant cotton without rotating, we can never hope to build up a great agricultural country. Our cotton seed meal, which is a most valuable food, is being used in large quantities as a commercial fertilizer. This is not economical. There is enough cotton seed meal each year strewn over our land as a fertilizer to feed thousands and thousands of cattle.

Alfalfa is now receiving considerable attention by the Station. We have a field that is producing more than three tons of hay per acre. These experiments lead us to believe that alfalfa can be grown in a number of sections of the State successfully when the proper conditions are maintained. It is highly necessary to apply lime, at the rate of about 1,000 lbs. per acre, and to apply an abundance of acid phosphate at the time of planting, and a good, liberal supply of stable manure. It is our belief that where failures have been made in the State with alfalfa it has been due to the lack of these necessary factors.

Experiments to determine the best time to apply fertilizers to oats have led us to the conclusion that this cereal should have an ample supply of nitrate of soda and a small amount of acid phosphate and potash applied to it in the spring,—this in addition to the fertilizer applied when the oats were planted in the autumn.

Other experiments being conducted by the Station in the Agricultural Division, are variety tests of wheat, corn, alfalfa, vetch, cow-peas and sweet potatoes.

The work done by the Chemical Department of the Station in the manufacture of starch from the sweet potato, has been of especial interest. That department has issued a most valuable bulletin on this subject. The soils of South Carolina are well adapted to the growing of sweet potatoes. Several hundred bushels are often produced on one acre of land, and from the results that have been obtained by the Chemical Department, we are of the opinion that the manufacture of starch from the sweet potato could be made a most profitable business in this State. This department of the Station, during the year, made a number of analyses for different divisions of the Station. The detailed report of Col. M. B. Hardin, chief chemist, is found appended.

The Horticultural Division has carried on extensive experiments in the testing and breeding of *Rotundifolia* grapes. This Station



has done more work with this type of grape than probably any other Station on the continent. The bulletin prepared by the Horticulturist on his experiments with the *Rotundifolia* grapes has been in great demand by fruit-growers throughout the entire country.

This division of the Station has also conducted experiments in the testing of Irish potatoes, comparing the first and second crop for spring planting, and comparing Northern and Southern grown seed for seed purposes, also experiments to determine the effect of spraying with Bordeaux mixture on the yield of Irish potatoes. A number of experiments have been conducted with tomatoes to determine the best variety,—the growing of tomatoes under glass, the breeding of new varieties and the stalk system compared with the ordinary method.

Other experiments made by this division are methods of blanching and storing celery, testing varieties of celery, comparing the keeping quality of onions grown from seed and grown from sets, variety test of onions covering a period of a number of years, experiments in the breeding of new varieties of onions, experiments with 125 varieties of grapes, the testing of a number of varieties of apples, peaches, pears, strawberries and muskmelons.

The Division of Veterinary Science has continued the work begun last year to determine the most practical methods of freeing pastures from the stomach worm. Results of these experiments will be published soon in bulletin form. This division, during the past year, issued a very instructive bulletin on the oxygen treatment for milk fever.

The Division of Entomology and Zoology has undertaken very extensive investigations to determine the biological character of the stomach worm. Some interesting results have been obtained from these experiments. This division is also investigating the ravages of the hook worm. A biological study is being made of the worm, and experiments conducted to determine the most practical method of eradicating it from pastures.

Other experiments being conducted by this division are: A study of the life history of the peach tree borer and its control; a study of the life history of the codling moth and its control; a study of the life history of the plum curculio and its control; a study of the life history of pecan insects and their control.

The work of the Division of Animal Husbandry of the Station, in determining the safest amount of cotton seed meal to feed to dairy cattle, when fed in conjunction with corn silage, is probably one of the



most interesting problems taken up by the Station. A portion of the Station herd has been fed cotton seed meal at the rate of six pounds per day per animal, without causing any apparent ill effects, after having been fed this amount for three years. This division has arrived at the conclusion that corn silage and cotton seed meal constitute the most economical ration to feed to dairy cattle at present for this section of the country. Corn silage can be produced more economically in South Carolina than in many of the Northern States that have made the dairy industry a success, while we have at our very doors a most valuable concentrated food in the form of cotton seed meal, which the Northern dairyman buys and transports.

It is the hope of this Station that the dairy industry will soon receive from the farmers the attention it richly deserves, as it is our belief that this is the most profitable line of business in which a number of farmers can engage. The South has yet an unlimited dairy market.

This division has also conducted experiments to determine the most economical grain ration for hogs.

The work of the Botanist and Bacteriologist of the Station was confined mainly to the study of the life history of the fungus, which causes anthracnose of cotton, and experiments relative to controlling the same. This has become one of the most destructive diseases to be found in the State. It is now causing the loss of thousands of dollars, and any remedy that will control and prevent the spread of this disease will be worth millions of dollars to the farmers of the South. This division conducted investigations of other diseases of cotton, such as root rot, boll rot, wilt, leaf spot, etc.; and experiments were conducted with the view of preventing the rotting of sweet potatoes. Valuable information concerning the fungi which cause the rotting has been obtained, and we are in hopes that in the near future methods of keeping the sweet potato will be devised that will be simple and economic.

Other experiments undertaken by this division were investigations in reference to the distribution and prevalence of the plant diseases present in the State, such as rust of wheat, oats, corn; smut of wheat, barley; powdery mildew of grain; leaf spot of vetch, clovers, etc.

During the past year the Station issued nine bulletins and one annual report. These were issued in editions of about 14,000 each. The Station now has on its mailing list more than 14,000 persons engaged in or interested in agriculture. In addition to these regular



bulletins there were distributed by the Secretary twenty-two weekly bulletins in editions of 14,000.

Detailed reports of the divisions of the Station are found appended.

This Station continues to cooperate with the U. S. Department of Agriculture in the following experiments: The testing of citrange trees with the Bureau of Plant Industry in cooperation with our Horticultural Division; the Entomological Division is cooperating with the Bureau of Entomology with cereal and forage crop insects; the Division of Botany is cooperating with the Bureau of Plant Industry in making a plant disease survey of the State, and with the Bureau of Forestry in testing methods of preserving fence posts with creosote; and the Agricultural Division is cooperating with the Bureau of Chemistry in the breeding of sweet corn; and cooperating with the Bureau of Plant Industry in testing various forage plants.

Most respectfully submitted,

J. N. HARPER,  
Director.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STA-  
TION IN ACCOUNT WITH THE UNITED STATES  
APPROPRIATION, 1907-1908.

Debtor.	Hatch Fund.	Adams Fund.
To receipts from the Treasurer of the United States as per appropriations for fiscal year ended June 30, 1908, under Acts of Congress, approved March 2, 1887 (Hatch Fund), and March 16, 1906 (Adams Fund). \$15,000 00		
Credit.	Abstract.	
By Salaries .....	1	8,078 65 \$4,441 42
Labor .....	2	1,391 06 1,285 99
Publications ..	3	2,262 72
Postage and stationery.....	4	87 61 52 02
Freight and express.....	5	173 21 14 40
Heat, light, water and power..	6	16 37
Chemical supplies .....	7	79 72 119 77
Seeds, plants and sundry supplies	8	444 58 72 65
Fertilizers ..	9	438 93 226 18
Feeding stuffs .....	10	784 00 1,731 65
Library ..	11	89 23



Tools, implements and machinery	12	199 04	189 25
Furniture and fixtures.....	13	16 15	5 50
Scientific apparatus .....	14	.....	464 95
Live stock .....	15	408 00	34 00
Traveling expenses .....	16	50 06	9 70
Contingent expenses .....	17	15 00	
Buildings and land.....	18	338 17	311 87
Fences and drainage.....	19	127 50	40 65
		<hr/>	<hr/>
Total ..		\$15,000 00	\$9,000 00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the South Carolina Agricultural Experiment Station for the fiscal year ended June 30, 1908; that we have found the same well kept and classified as above; that the receipts for the year from the Treasurer of the United States are shown to have been \$15,000 under the Act of Congress of March 2, 1887, and \$9,000 under the Act of Congress of March 16, 1906, and the corresponding disbursements \$15,000 and \$9,000; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving balances of \$                      and \$                      .

And we further certify that the expenditures have been solely for the purposes set forth in the Acts of Congress, approved March 2, 1887, and March 16, 1906, and in accordance with the terms of said Acts, respectively.

(Signed) R. W. SIMPSON,  
Chairman Finance Committee, Auditors.

Attest: P. H. E. SLOAN, Custodian.

## SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION, 1907-1908.

### (SUPPLEMENTARY STATEMENT.)

(This supplementary statement, while not required by law, is desired as an aid in interpreting the account rendered for the United States appropriation. While it will be more useful if made in conformity with the schedule fixed for that appropriation, if this is not practicable such a summary of receipts and expenditures from the sources indicated below as can be conveniently prepared from the books of the Station may be substituted. Whenever practicable, it should be for the fiscal year ended June 30.)



## DEBTOR.

*To Receipts from Other Sources Than the United States of the Year Ended.*

Balance July 1, 1907.....	\$1,628 01	
Received to July, 1908.....	1,809 75	
	<hr/>	
Total ..		\$3,437 76

## CREDIT.

By Salaries .....	\$754 12	
Labor .....	71 40	
Publications .....	113 62	
Postage and stationery .....	5 19	
Freight and express.....	30 19	
Seeds, plants and sundry supplies.....	251 79	
Fertilizers ..	4 65	
Library ..	17 86	
Live stock .....	5 00	
Traveling expenses .....	8 82	
Contingent expenses .....	74 05	\$1,336 69
	<hr/>	<hr/>
Balance ..		\$2,101 07



## REPORT OF CHEMIST.

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Clemson College, S. C., September 19, 1908.

Prof. J. N. Harper, Director, South Carolina Experiment Station.

Sir: I respectfully submit the following report of the Chemical Department of the Station for the year ending June 30, 1908:

The work done by Mr. C. C. McDonnell in 1905 and 1906 on the manufacture of starch from sweet potatoes has been published in Bulletin 136. As Mr. McDonnell resigned his position here in March, 1907, the dried samples of potatoes, pulp, and starch of 1906 were placed in the hands of Mr. T. E. Keitt, whose analyses appear in the Bulletin referred to. The work was continued in 1907, but on account of unavoidable difficulties the investigation was not carried out fully in accordance with the original plan. However, Mr. B. F. Robertson prepared nearly one hundred pounds of starch from the variety of potatoes known as Southern Queen, and over sixty pounds from a mixture of six varieties, the samples of which were too small for separate runs. The analyses of the potatoes, pulp and starch were made by Mr. T. E. Keitt. The results of the work in 1907 were about the same as those obtained in 1905 and 1906.

Mr. D. H. Henry made for the Dairy Division a determination of the melting point of a fat, and did some very interesting work in cooperation with the Agricultural Department on five samples of soil, two surface and three sub-soils, sent by a citizen of the State on account of marked differences in plant growth on different parts of the same small area.

The Department sustained a loss last December in the death of Mr. F. S. Shiver, who had been a faithful and efficient Station officer since 1891, and, in addition, an Instructor and Assistant Professor of Agricultural Analysis since 1895.

### ANALYSIS OF COMMERCIAL FERTILIZERS.

Following is a report of the work on commercial fertilizers done under the direction of the Board of Fertilizer Control:

#### SUMMARY.

	1906-7.	1907-8.
Official samples .....	743	713
Farmers' samples .....	43	45
	<hr/> 786	<hr/> 758



Fifteen official samples were analyzed, which are not included in the foregoing summary, as the analyses were not published in Bulletin No. 138, which is the basis of the present report.

### OFFICIAL SAMPLES OF FERTILIZERS.

The analyses of 713 samples are given in full in Bulletin No. 138.

#### CLASSIFICATION.

	1907.	1908.
Complete fertilizers .....	390	363
Acid phosphates .....	111	91
Acid phosphates with potash.....	72	64
Cotton seed meals .....	99	114
Kainit .. .....	30	39
Nitrate of soda .....	20	17
Muriate of potash .....	13	15
Nitrate of potash .....	0	1
Sulphate of potash .....	1	2
Nitrate of soda with potash.....	3	0
Dried blood .....	1	4
Miscellaneous .. .....	3	3
<hr/>		<hr/>
Total .. .....	743	713

#### DEFICIENT SAMPLES.

Of the 713 samples reported, 55 fell below the commercial value, based upon guarantee, and of these, 25 fell 3 per cent. or more below that value.

In addition to these there were 161 samples below the guarantee in one or more constituents, the deficiency, however, being made up by an excess of other constituents.

They are as follows:

In available phosphoric acid.....	18
In available phosphoric acid and potash.....	1
In ammonia and potash.....	11
In ammonia .....	77
In potash .....	54
<hr/>	
Total .. .....	161

The extent to which they fell below guarantee is shown in the following table:



	Below Guarantee—Per Cent.				
	0-.10	.10-.25	.25-.50	.50-1.00	1.00 and over
In available phosphoric acid . . . .	3	5	5	3	3
In ammonia . . . . .	22	42	20	4	0
In potash . . . . .	9	19	22	14	2
Total . . . . .	34	66	47	21	5

## AVERAGES OF ANALYSES.

	1907 Per Cent.		1908 Per Cent.	
	Found	Guaranteed	Found	Guaranteed
<b>ACID PHOSPHATES—</b>				
Soluble phosphoric acid . . . . .	11.17	.....	11.29	.....
Reverted phosphoric acid . . . . .	3.78	.....	3.42	.....
Available phosphoric acid . . . . .	14.95	14.10	14.71	14.18
Insoluble phosphoric acid . . . . .	.66	.....	.65	.....
Total . . . . .	15.61	.....	15.36	.....
<b>ACID PHOSPHATES WITH POTASH—</b>				
Soluble phosphoric acid . . . . .	7.62	.....	7.12	.....
Reverted phosphoric acid . . . . .	3.14	.....	3.45	.....
Available phosphoric acid . . . . .	10.76	9.91	10.57	9.91
Insoluble phosphoric acid . . . . .	.72	.....	.66	.....
Total . . . . .	11.48	.....	11.23	.....
Potash soluble in water . . . . .	3.21	3.11	3.54	3.34
<b>COMPLETE FERTILIZERS—</b>				
Soluble phosphoric acid . . . . .	6.27	.....	6.32	.....
Reverted phosphoric acid . . . . .	2.64	.....	2.85	.....
Available phosphoric acid . . . . .	8.91	7.92	9.17	8.28
Insoluble phosphoric acid . . . . .	1.45	.....	1.36	.....
Total . . . . .	10.36	.....	10.53	.....
Ammonia phosphoric acid . . . . .	3.29	3.24	3.01	2.91
Potash soluble in water . . . . .	3.29	2.71	3.01	2.77
<b>COTTON-SEED MEALS—</b>				
Available phosphoric acid . . . . .	2.68	1.48	2.37	1.50
Ammonia . . . . .	7.32	6.91	7.40	7.03
Potash soluble in water . . . . .	1.69	1.00	1.61	1.00
<b>KAINIT—</b>				
Potash soluble in water . . . . .	12.78	12.00	12.91	12.00
<b>MURIATE OF POTASH—</b>				
Potash soluble in water . . . . .	51.52	48.75	51.04	48.84
<b>SULPHATE OF POTASH—</b>				
Potash soluble in water . . . . .	48.20	48.00	50.09	48.00
<b>NITRATE OF SODA—</b>				
Ammonia (equivalent) . . . . .	18.49	18.26	18.33	18.07

The following table shows the yearly averages of fertilizer analyses from the time the Board of Trustees of this College took charge of the Station work down to the present time:



YEARLY AVERAGES OF ANALYSES FROM 1891 TO 1908, INCLUSIVE.

SEASON	Acid Phosphates			Acid Phosphates with Potash			Complete Fertilizers			Cotton Seed Meals				Kainits			Muriate of Potash		Nitrate of Soda.	
	Number of Samples	Available Phosphoric Acid Per Cent.	Number of Samples	Available Phosphoric Acid Per Cent.	Potash, Solu-ble in Water Per Cent.	Number of Samples	Available Phosphoric Acid Per Cent.	Ammonia Per Cent.	Potash, Solu-ble in Water Per Cent.	Number of Samples	Available Phosphoric Acid Per Cent.	Ammonia Per Cent.	Potash, Solu-ble in Water Per Cent.	Number of Samples	Potash Per Cent.	Number of Samples	Potash Per Cent.	Number of Samples	Ammonia Per Cent.	
1890-1..	49	13.02	19	11.84	1.65	173	9.34	2.86	1.96	30	.....	8.37	.....	21	12.75	1	51.96	1	19.22	
1891-2..	29	12.92	16	11.50	1.49	112	8.83	2.80	1.95	25	.....	8.21	.....	18	12.51	.....	.....	.....	18.03	
1892-3..	48	12.82	26	11.63	1.22	150	9.00	2.91	1.65	20	2.62	8.40	1.32	20	12.05	.....	.....	.....	.....	
1893-4..	46	13.24	22	12.01	1.51	132	9.27	2.53	1.79	22	2.45	8.64	1.69	17	12.37	.....	.....	.....	.....	
1894-5..	46	13.55	15	12.09	1.66	87	9.42	2.55	1.77	33	2.58	8.19	1.66	19	12.30	.....	.....	.....	.....	
1895-6..	42	13.43	25	11.99	1.39	115	9.31	2.64	1.86	34	2.57	8.45	1.61	16	12.45	.....	.....	.....	.....	
1896-7..	59	13.61	24	12.06	1.61	117	9.55	2.70	1.91	40	2.53	8.69	1.64	22	12.44	.....	.....	.....	.....	
1897-8..	63	13.67	50	11.54	1.90	141	9.15	2.70	1.93	39	2.37	8.39	1.58	20	12.68	.....	.....	.....	.....	
1898-9..	73	13.74	63	11.77	1.99	134	9.32	2.73	2.21	52	2.27	8.73	1.63	8	12.73	2	51.93	2	19.23	
1899-1900..	73	13.58	63	11.58	2.05	124	9.50	2.73	2.13	52	2.27	8.73	1.63	8	12.73	4	50.95	3	18.96	
1900-1..	56	14.00	55	11.49	2.65	139	9.40	2.87	2.47	60	2.38	8.55	1.54	12	12.61	2	48.92	3	19.01	
1901-2..	45	14.11	51	11.09	2.55	141	9.39	2.84	2.34	49	2.57	7.93	1.63	16	12.85	4	50.54	3	19.03	
1902-3..	51	13.74	53	10.94	2.65	139	9.02	2.69	2.42	69	2.27	7.93	1.63	16	12.85	4	50.54	3	19.15	
1903-4..	59	14.32	73	11.12	2.81	180	9.12	2.99	2.42	69	2.27	7.92	1.48	15	12.92	2	50.25	2	19.15	
1904-5..	81	14.81	82	10.70	3.07	250	9.19	3.12	2.90	57	2.28	7.92	1.54	26	12.94	7	49.79	6	18.87	
1905-6..	87	14.95	94	10.97	3.30	375	9.34	3.26	2.98	71	2.42	7.42	1.54	26	12.54	6	50.40	7	18.73	
1906-7..	111	14.95	72	10.76	3.21	390	8.91	3.29	3.29	99	2.68	7.32	1.57	29	12.83	13	50.06	10	18.67	
1907-8..	91	14.71	64	10.57	3.54	363	9.17	3.01	3.01	114	2.37	7.40	1.61	39	12.91	15	51.04	17	18.33	



In this table, as in the preceding ones, the ammonia yielded by the nitrogen in fertilizers is given instead of the nitrogen itself, as in the trade goods are still bought and sold on the ammonia basis. The per cent. of nitrogen is readily calculated, as fourteen-seventeenths of the ammonia is practically the weight of the nitrogen it contains.

#### GRADES.

In the following table the number of acid phosphates, acid phosphates with potash, and complete fertilizers of each grade, according to the guarantee, is placed side by side with the number found by analysis to belong to that grade, fertilizers having commercial values equal to those of schedule grades being classed in those grades:

	High		Standard		Low	
	Claimed	Found	Claimed	Found	Claimed	Found
Complete fertilizers (363) . . . . .	186	222	156	132	21	9
Acid phosphates with potash (64) . . . . .	34	49	30	11	0	4
Acid phosphates (91) . . . . .	90	91	1	0	0	0
Total (518) . . . . .	310	362	187	143	21	13

These results are due to the following changes in grades, ascertained by analysis:

	Low to High	Low to Standard	Standard to High	High to Standard	High to Low	Standard to Low	No change
Complete fertilizers (363) . . . . .	2	13	39	5	0	3	301
Acid phosphates with potash (64) . . . . .	0	0	17	2	0	4	41
Acid phosphates (91) . . . . .	0	0	1	0	0	0	90
Total (518) . . . . .	2	13	57	7	0	7	432

This shows that out of 518 samples, 432 were of the grade claimed for them, 72 were of a higher grade, and 14 of a lower grade than that claimed for them. Last year out of 573 samples, 479 were of the grade claimed for them, 85 were of a higher grade, and 9 of a lower grade than that claimed for them.



## FARMERS' SAMPLES OF FERTILIZERS.

In addition to the samples of fertilizers collected by the official inspectors there have been analyzed this year 45 samples for individual purchasers as provided for in Section 1540 of the law respecting commercial fertilizers.

## WATER.

There have been made this year 50 analyses of water from different parts of the State. Of these 42 were sanitary examinations, the rest mineral water analyses.

## DISTRIBUTION OF THE WORK.

Fertilizers were analyzed by Messrs. B. F. Robertson, J. H. Mitchell, T. E. Keitt and C. V. Cornell; water mainly by Mr. D. H. Henry. Dr. R. N. Brackett aided me in office duties, and made addresses at twelve Farmers' Institutes.

Very respectfully,

M. B. HARDIN,  
Chief Chemist.



## REPORT OF HORTICULTURIST.

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Clemson College, S. C., November 25, 1908.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I beg to submit the report of the progress of the experiments conducted in the Horticultural Division of the South Carolina Experiment Station for the year ending June 30, 1908.

The experiments conducted during the past year have been practically the same as those mentioned in my last report, with the exception that a few mentioned in the report of 1907 have been completed and therefore discontinued.

Our experiments in breeding tomatoes, muskmelons and grapes have been continued.

We have now under way about four hundred seedling tomatoes, most of which are crosses made from the leading varieties with special reference to securing a variety resistant to plant diseases. In our lot of seedlings tested last year three of the number produced tomatoes of fine shape and size and the fruit was decidedly freer from diseases than any of the varieties tested. We have made quite a number of crosses from these seedlings during the past year and hope to produce some valuable varieties.

The breeding experiments with the muskmelons were continued under glass during the winter and then in the field in the spring. By growing these melons under glass in the winter and continuing the crossing enables us to get results more rapidly than we would be able to do otherwise. We have several varieties now under way that appear to be practically free from the wilt disease. These varieties, however, will be tested more thoroughly during the coming season.

Our crosses made from varieties of *Rotundifolia* grapes are doing well, but as yet none of them have produced fruit.

Our experiments in growing cabbages for fall and winter have been continued. Our best results have been obtained from plants set in the field August 15th. These cabbages were ready for cutting by October 20th, many of the heads at that time weighing from four to six pounds. By November 25th the majority of cabbage had reached maturity, the heads weighing from six to fourteen pounds. Cabbage plants set in the field the fifteenth of September produced heads averaging about two pounds less than those planted the 15th of August. Plants set out the 15th of October headed up nicely during



the months of January and February. The heads, however, were rather small, averaging three and a half pounds. The best variety to use for winter is the Drum Head Savoy. This variety will stand more cold than any we have tested. If the plants are expected to head before the last of December any of the ordinary winter varieties will do, but if they are to be allowed to remain in the field after this time the Savoy is about the only variety that will not be injured by the severe cold. For fall use the Succession and Charleston Wakefield have given best results, the Charleston Wakefield heading about three weeks earlier than the Succession. The Flat Dutch is probably the best variety to follow the Succession.

For spring planting the cabbage seed should be sown in the open ground some time between October 15th and November 1st. If the seed are sown in the early part of September the plants will make too much growth in the fall and when transplanted the next spring a large percentage of them will run to seed rather than form heads. If the seed are planted about the middle of October the plants will form about five or six leaves before very cold weather and will then remain practically in a dormant condition until spring, when they may be taken up and transplanted to the field where they are to head. It is generally supposed that the cabbage will not withstand our winter, but when planted at the time stated above there is no danger of their being killed provided the temperature does not drop below ten degrees. If the seed are sown in December and the plants do not have time to become well-established before severe weather they will be killed.

Our experiments in pruning okra have been continued, and the results of these experiments have been very interesting. As okra is ordinarily planted the rows are five feet apart and the plants left three feet apart in the row. If the plants are pruned as soon as the side limbs appear, the rows need not be more than three feet apart and the plants may be allowed to stand twelve inches apart in the row. The pruning is very simply done, and there is no necessity of going over the field but once, as the okra does not sprout from the stalk after these limbs have been removed. The yield from the pruned plot is just three times as heavy as that from the unpruned stalks or the ordinary method of growing okra. The lateral branches on the okra plant produce very few pods, but take up a considerable amount of room and prevent the plants from being left close together. The main stem of the okra plant will usually produce from three to four times as many pods as all of the lateral branches combined.



The results of these experiments will be given more fully in the bulletin which is now practically ready for the press.

Our experiments in different methods of keeping the first crop of Irish potatoes have been continued. The past season we kept the first crop of potatoes in perfect condition, not losing one per cent. of the entire lot. Our best results were obtained where the potatoes were put on shelves placed one above the other eighteen inches apart, the first shelf being about twelve inches from the floor of the cellar and the last shelf about six or seven feet from the floor. The shelves are four feet wide and the potatoes may be easily reached from either side or from the alleys extending between the rows of shelves. The bottom of the shelves are covered with three-inch slats placed one inch apart. This affords free circulation of air and keeps the potatoes cool and dry. The potatoes were piled on these shelves about six inches deep.

Our next best results were obtained where the potatoes were placed in slat boxes holding one bushel each and then placed on the slat shelves. This is decidedly the best way of handling the potato, but there is more danger of their rotting when placed in bushel crates. When they are loose on the shelves any decayed potato may be noticed at once and is easily removed, while it is hard to locate and remove the decayed potatoes from the bushel crates. These experiments will be continued during the next year, when our results will be ready for publication.

Our young orchard of seedling apples bore a few fruits this year and some of them are very promising indeed. Next season these trees should produce enough apples for us to tell something about their value. A more detailed account of these experiments was given in our report of 1907. At present the Rabun, Black Winesap and Thin Skin appear to be among the most promising seedlings. Our old apple orchard this year produced a wonderful crop of fruit, many of the trees producing as many as fifteen bushels of perfect apples. The trees were so heavily loaded, however, that the fruit was below the average in size.

The pecan trees all produced a fair crop this season and some of the seedling trees produced nuts of excellent quality, and we believe they are worthy of propagation, especially for planting in the Piedmont section of this State. A great many of the best varieties of pecans fail to mature their nuts before frost in this section of the State, and therefore it is of great importance that we secure, if possible, a first-class early variety that will mature its nuts before frost.



We were able this year to secure detailed descriptions of more than one hundred varieties of grapes. These notes, combined with notes taken during the past four years, are now being put in shape for publication.

Our experiments in growing tomatoes under glass have been continued.

Our experiments in grafting apples in order to determine the length of stock and scion to use to produce the largest number of first grade trees, have been continued. The results in the accompanying table will be of interest to those who grow apple trees for the trade.

Straight or Western stocks were used in this experiment.

There were ten grafts in each plot:

PLOT	Length of Stock used	Length of Scion used	Average height of Trees after first year's growth	Number of first grade Trees produced	Number of second grade Trees produced	Number of third grade Trees produced	Number of Grafts that failed to grow
1 .....	12 in.	18 in.	5 ft.	6	3	1	0
2 .....	12 in.	12 in.	5 ft. 6 in.	8	2	0	0
3 .....	12 in.	8 in.	5 ft. 8 in.	8	2	0	0
4 .....	12 in.	4 in.	5 ft. 8 in.	10	0	0	0
5 .....	12 in.	2 in.	5 ft. 8 in.	9	1	0	0
6 .....	6 in.	18 in.	3 ft. 8 in.	0	6	4	0
7 .....	6 in.	12 in.	4 ft. 6 in.	6	3	1	0
8 .....	6 in.	8 in.	5 ft.	8	2	0	0
9 .....	6 in.	4 in.	6 ft.	10	0	0	0
10 .....	6 in.	2 in.	6 ft.	10	0	0	0
11 .....	3 in.	18 in.	3 ft.	0	1	4	5
12 .....	3 in.	12 in.	3 ft. 6 in.	0	3	5	0
13 .....	3 in.	8 in.	4 ft. 6 in.	0	6	3	1
14 .....	3 in.	4 in.	5 ft. 3 in.	4	5	1	0
15 .....	3 in.	2 in.	5 ft.	8	1	1	0

Respectfully,

C. C. NEWMAN,  
Horticulturist S. C. Experiment Station.



## REPORT OF AGRICULTURIST.

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Clemson College, S. C., June 30, 1908.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I respectfully submit the following report for the Agricultural Division of the Experiment Station:

In my report of November 23, 1907, it was stated that material was ready for five bulletins. Since this report was submitted two of these bulletins have been prepared and one, "The Williamson Plan in 1907," has been published; the other, "Cotton in 1907," is now in the hands of the printer. Time has not been found for the completion of the other three. These embrace work done with cowpeas, wheat and corn.

The work begun with cotton three years ago has occupied more of my time and attention than probably all other work undertaken. This embraces the study of established varieties and their improvement by pedigree selections; the origination and development of hybrids; and, a study of the qualities of cotton which give value to lint, together with the collection of data showing the great loss, to the farmer producing cotton, resulting from the absence of uniform standards for the grading, classification and pricing of cotton in local and other markets. A preliminary report embracing, in part, data relative to the above problems will be found in Bulletin No. 140. There is no feature of cotton investigation of more importance to the people of the State than that leading to the protection of the producer in the marketing of lint. Cotton overshadows all other crops of the State, and the Experiment Station could well afford to give cotton production the attention it deserves. Several hundred plots of cotton are now growing in the cotton breeding grounds and ample equipment for this work is provided. This work has been undertaken on a larger scale probably than ever before in the United States, and there never was a more appropriate or more opportune time for this character of work. The progress and extent of the work in cotton breeding now under way, if continued, will easily place the Clemson College Experiment Station far in the lead in this paramount line of investigation.

The work with corn, wheat, oats, sorghum, millet, rice, cowpeas, vetch, Soy beans, alfalfa, clover, grass, etc., referred to in previous reports has been continued. A number of strains of alfalfa, flat pea



and vetch have been procured through the National Department of Agriculture and are being grown for the purpose of securing strains adapted to the State. The cooperative corn variety test undertaken at the request of the National Department of Agriculture is concluded; and the sweet corn cooperative work is continued. A number of miscellaneous plants furnished by the Department are being tested, and several minor problems are under investigation or observation.

Respectfully submitted,

C. L. NEWMAN.



## REPORT OF GEOLOGIST.

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Clemson College, June 30, 1908.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: During the fiscal year ending June 30, 1908, sixty photographs and photo-micrographs were taken for the other officers of the Station engaged in experiment work. Minerals, rocks, clays, sands, soils and road materials sent to the division by people in the State were examined and reported upon. Material for a bulletin upon gullying, its cause and its prevention, was gathered and photographs to illustrate the same were taken. Material collected last year for a bulletin upon the geological relations of soils in South Carolina was turned over to the Division of Agronomy. Meteorological observations were continued during the year.

Respectfully submitted,

(Signed) F. H. H. CALHOUN,  
Geologist.



## REPORT OF ASSOCIATE PROFESSOR OF ANIMAL INDUSTRY AND DAIRYING.

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Clemson College, June 30, 1908.

Prof. J. N. Harper, Director, Agricultural Experiment Station.

Sir: Cotton seed meal has been used as a grain for cattle for many years, and in most sections a feeling prevails that its use in even moderate quantities is liable to produce troubles more or less alarming, particularly when given to dairy cows and hogs.

The writer must confess to having had this feeling very firmly fixed from rumors heard in early life and has seen it proven to be true, so far as its use for swine is concerned, but opinion of results following its use for cattle has been considerably modified. Having seen steers in Virginia fed large quantities of cotton seed meal, and it being used with no other grain, caused us to more and more rely on it as a food for dairy cows, and the increased amount given was not attended by any evil.

On coming to this Station, in September, 1907, we found that cotton seed meal had been used in even larger quantities than we had before fed it, and that it had been the exclusive grain ration for a year or more. We determined to continue its use with a large portion of the herd, to study its effects and note any ills it might bring when fed continuously for a long period. This is a question of great import to the entire South, and to a lesser extent, to all the dairy sections of the North, for in these years of extremely high prices of most grains, this product has not advanced in proportion with the others, and if demand can be increased, it must mean added income to the cotton grower and an economical grain for the Northern dairyman.

In our feeding experiments the aim was primarily to study the effect of the meal on the dairy cows, when fed in some considerable quantity, i. e., five to six pounds per day to average sized Jersey cows, said amount being slowly decreased as period of lactation advanced. Beside this, we desired to show cost of butter production with cotton seed meal as the grain ration, that we might compare its value to other grains, particularly as most other concentrates are purchased in large quantities in Southern States.

In many portions of the country, the great cry is for concentrates and roughages that can with economy supply the necessary protein.



In this State we have no such question if we can use the cotton seed meal, particularly when we can so easily grow cowpeas. With these two crops, we may feed an excess of protein and yet keep the cost of such feeds at a low point. Again, as corn can be grown easily, and as the larger varieties that make fine silage will mature here, this adds an economical food that may be used in conjunction with those before mentioned.

In our work, on account of local conditions and that we might the more easily note effect of the cotton seed meal on our cows, we fed a number of them on corn silage and cotton seed meal, giving *no* other food of *any* kind, except grasses from a rather poor pasture.

Two of the ills most commonly ascribed to the feeding of cotton seed meal are abortion and troubles of the udder, known as garget. The herd we handled was unfortunate enough to have been troubled with contagious abortion several years ago, and was, we understand, so affected when the feeding of the cotton seed meal began, but that it gradually disappeared from the herd, though, of course, such means as segregation, disinfectants, etc., were used as a means to lessen the evil.

During the nine months we conducted the work we had one case of abortion, and while no cause is known for it, the Veterinary Department saw no reason to believe it came from the feeding the cotton seed meal, though no positive assertion can be made in either direction. With this exception the herd has been very healthy. No udder that was in normal condition when we began feeding the meal is now involved with any trouble, and the herd, as a whole, is in a very thrifty condition, and was reported by members of the Board of Trustees at their meeting in July "to appear in better condition than it ever had before."

That silage and cotton seed meal may be used as a feed with economy may be shown by citing the case of a Jersey in the herd, the cow, Exile Bessie, No. 162507:

From February 3, 1907, to February 3, 1908, she produced 7,021.1 pounds milk, and from that gave 442.3 pounds butter, as estimated by the Babcock test. She had pasturage for five months and silage for seven, with six pounds cotton seed meal per day for three months, five pounds per day for seven months and a lesser amount, with bran and linseed meal, near time of dropping calf. The amount of silage varied from 40 to 45 pounds per day, but was as much as she would eat without waste.



When getting her highest feed she obtained 9.4 pounds dry matter from the silage and 5.5 pounds dry matter from the meal, a total of about fifteen pounds, this being much lower than accepted standards call for, yet she not only gave the amount of milk and butter mentioned, but kept in good flesh and gave every evidence of thrift.

This cow and most of the others were given a change of feed just before and after dropping their calves, using some bran and linseed meal, as we desired grains that have laxative properties. We do not contend that cotton seed meal should be given in any considerable quantities at such times, any more than one would give a large ration of corn meal, for the use of either would be attended with some danger, yet in several instances where we continued the use of cotton seed meal through the entire year, we had no bad effects to follow.

Considering the cost of the food given the cow mentioned above, she ate in one year 8,900 pounds silage, 1,720 pounds cotton seed meal, 132 pounds bran and 30 pounds linseed meal, besides grass for five months.

If we consider silage as worth \$2 per ton, and figure the grains at cost, the total would not be over \$40, including a fair allowance for the pasturage. In fact, had she been fed all grain and silage at rate as averaged for the year, getting *no* grass at all, yet the cost would have been not more than the \$40.

This is without doubt the cheapest combination that can be used for this section. It is true many object to the use of only two food stuffs and more would probably be better, though first cost would be greater, but with this as a basis, one may work out rations to suit local conditions.

Oats succeed admirably in most parts of the State, and if sown thick and cut green, they make a hay that would be a valuable addition to the articles consumed. These, with corn stover and pea hay, all of which are easily produced in the South, would answer all needs.

Beside, the animals fed for purposes as above mentioned, we gave to others a ration supplementing half the cotton seed meal with an equal weight of rice bran. The composition of these two grains are such that we might expect them to feed well together, and perhaps they would if the cows became accustomed to the rice while young. With our mature cows, they would at times refuse to eat it, so often indeed, that we could get no basis of comparison.



If given in very small quantities it would, without doubt, prove a good addition to our food stuffs, particularly as at times it is considerably cheaper than most other concentrates.

#### SUMMARY.

1. Cotton seed meal given at rate of six pounds per day caused no apparent ills after having been fed for three years.
2. Corn silage and cotton seed meal is most economical food at present for this section.
3. With this combination the cows received but little more than half the amount of dry matter that a theoretical correct ration demands, though the protein was nearly up to the standard.
4. That despite this fact the cows gave every evidence of thrift, appeared to digest the food perfectly and gave satisfactory returns in dairy products.

Respectfully submitted,

D. O. NOURSE.



## REPORT OF BOTANIST AND BACTERIOLOGIST.

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Clemson College, S. C., June 30, 1908.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I beg leave to submit the following report of the Botanical Division of the Experiment Station for the year ending June 30, 1908:

The teaching for this division in the College and Station has been unusually heavy for this year. The number of hours of actual teaching each week was 23, 27 and 33 for the first, second and third terms, respectively. Aside from these regular hours of teaching the collection and preparation of material for laboratory and class-room work has taken considerable time and attention.

The correspondence of the office has been as large as usual.

The identification of various plants and plant diseases, which have been sent in from time to time, has been carefully looked after and much information has been given out in this way by personal letters. At the suggestion of the Director some preliminary work has been undertaken in connection with the rot-producing organisms of sweet potatoes. In this some interesting things have developed in reference to the prevalence of certain species of fungi which cause these rots and in the way of rot-producing organisms which seem to have been previously overlooked. In case this investigation is continued by the Station next year it is to be hoped that there will be more time available for making a complete study of these fungi and their effect on sweet potatoes in storage.

As an Adams Fund project some study of cotton anthracnose has been undertaken. A plan for making further investigations of the life history of the organism and of its method of infection was drawn up and submitted to the office soon after the present incumbent took up the work here last September. This was approved by the Office of Experiment Stations, but no money was appropriated by the committee here for carrying the plan into effect until late in March. At this time the writer was carrying thirty-three hours of teaching a week and had no time for investigation. This is a piece of work that is very interesting from a scientific as well as important from a practical standpoint. Nothing has been done on it within the



past few years and there is good reason to believe that with modern methods and concentrated effort something new can be learned in reference to the life history of the fungus and its method of gaining entrance into the plant. This investigation will be continued with renewed energy after July 1st, and it is to be hoped that this summer will afford good opportunity for obtaining important data in reference to the fungus (*Coliletotrichum gossypii*) and its habits.

With the complete separation of the Station and College Divisions of Botany, which takes place July 1st, the Station Botanist will have more time to devote to this kind of work.

Respectfully submitted,

HENRY W. BARRE,  
Botanist and Bacteriologist.



## REPORT OF VETERINARIAN.

Clemson College, S. C., June 30, 1908.

Prof. J. N. Harper, Director, S. C. Experiment Station, Clemson College, S. C.

Dear Sir: I have the honor to submit the following report of the work of the Veterinary Division of the Experiment Station for the fiscal year ending June 30, 1908:

During the past year the duties of this office have been greatly increased by the additional work of tick eradication, now being conducted by this State in cooperation with the Bureau of Animal Industry, and for this reason it has been impossible to devote sufficient time to Station work.

On taking charge of the Division in September, 1907, I found experiments in progress to determine the most practical method of eradicating stomach worms from infested pastures. Funds were also available for investigating the relation of cotton seed meal feeding to barrenness, abortion and diseases of the udders of milch cows.

### STOMACH WORM EXPERIMENT.

A series of experiments to determine the most practical method of freeing pastures from this parasite has been in progress for some time and will be continued until fall. Several important facts have been determined by these experiments and the control of the disease will consequently be facilitated.

The efficacy of drugs usually administered for the destruction of this parasite has also been investigated and the results emphasize the importance of preventive measures rather than medical treatment.

Stomach worms (*Strongylus contortus*) cause severe losses among the sheep and young cattle of this State, especially during the wet seasons, when conditions are favorable for the development of the parasite. Similar losses are reported in many States, and it is important that this investigation should be continued by a veterinarian in the employ of this Station until a satisfactory method for the control of this parasite is discovered.

During the past year the study of this problem has been complicated by the introduction of the hook worm (*Uncinaria radiata*), a common parasite throughout the South, but one that has not appeared before at this Station.



## COTTON SEED MEAL EXPERIMENT.

As the study of this problem would demand more attention and time than could be given without neglect of College and State work, it was decided, after consultation with the Director, to postpone these investigations until more time was available for their continuation.

This is another problem of vital interest to farmers in the South, and one that can only be undertaken by a veterinarian. Owing to the fact that there are so many important problems that cannot be investigated without the aid of a veterinarian, it is to be regretted that this Station will have no veterinarian on its staff in the future.

## OXYGEN TREATMENT FOR MILK FEVER.

A description of this disease and a record of successful application of the oxygen treatment at this Station has been published as Bulletin No. 139.

Very respectfully,

M. RAY POWERS,  
Veterinarian.



## REPORT OF ZOOLOGIST AND ENTOMOLOGIST

Clemson College, S. C., December 7, 1908.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I herewith submit my report of the Division of Zoology for the fiscal year ending June 30, 1908. The writer began his duties October 11, 1907, and as there were no records of the work of the Division, there could be no continuation of problems already begun. This was unfortunate, because under these conditions unnecessary repetition could not be avoided.

### STOMACH WORM INVESTIGATIONS.

Although you requested that this should be the principal investigation in this Division, owing to the approach of cold weather, when the Zoologist began his duties here, this work could not be carried on in a very satisfactory manner. On account of the continual presence of other notorious parasites which were at that time causing the principal loss to the cattle of the College farm, the Zoologist, with your permission, interpreted the investigation to include those parasites, and the investigation was prosecuted vigorously during the entire winter and spring. The parasites included in this work were stomach worm (*H. contortus*), hook worm (*M. phlebotomus*), hair worm (*C. punctata*), and the inflated bowel worm (*A. inflatum*). These species are all parasites of the alimentary canal of cattle, and are distributed principally as follows: Stomach worm in the pyloric region of the fourth stomach; hook worm and hair worm in the upper portion of the duodenum, while the inflated bowel worm occurs in the cæcum. Of these parasites mentioned the first three alone seem to have any economic importance, while the hook worm has been the chief, if not the sole, cause of the death of animals at this Station during the past winter and spring. (This does not refer to the epidemic outbreak occurring among the young cattle on the College farm during the last week in April.) While the work on stomach worm was carried on as thoroughly as possible our principal attention was directed to the hook worm. *M. phlebotomus* and *Cooperia punctata* have received little attention by American investigators, and owing to the originality of most of the work done on these parasites, as well as the fact that they were not reported from



South Carolina before, these preliminary investigations have already been published in Bulletin 137 of this Station.

While the investigation has been planned to cover almost every conceivable phase of the subject, it must be remembered that the problem is a tremendous one, and with the meager working power we have at the present time, it is necessary to take it up in sections. The principal experiment in progress at the present time is to determine some practical method for eliminating the serious effects of infestation in the animal by grazing on pasture presenting definite conditions. The project is an extensive one, but suffice it to say that lots have been prepared at the College farm where the best conditions exist for this experiment. The animals used in this experiment belong to the College farm and are furnished by Mr. J. P. Lewis, the farm superintendent. Whatever results are obtained will apply to all of the parasites mentioned above.

#### OTHER INVESTIGATIONS.

Owing to the meager records of South Carolina insects it is necessary to work out certain points about our common insects in order to enable us to give reliable and practical information to the correspondents of this Division. These investigations may be briefly summarized as follows:

*Peachtree Borer*.—In order to control this insect in the most rational manner, it is necessary to know as nearly as possible the pupation period. Fortunately we have the careful records of Prof. C. C. Newman, who studied this insect through one season a number of years ago. It is desirable, however, to repeat this work several seasons, because this insect, like most other species, is responsive to climatic conditions.

*Codling Moth*.—There are no records of the broods of the codling moth for South Carolina. A knowledge of this point is absolutely essential for the successful control of this insect. This work is in progress and has been carried on by two senior students, Messrs. Gee and Baker.

*Plum Curculio*.—This insect has long been known as a fruit pest, but it is only in recent years that it has adopted the peach extensively as a food plant in the South. Regarding its control on peach there is nothing definitely known. Preliminary to contemplated work on this subject, we are for the first time studying the life history for South Carolina. Besides the biologic work, close attention is given to the parasites that destroy the larva. These several inves-



tigations are in progress and will be continued through the year, if possible.

*Pecan Insects.*—A study of pecan insects has been begun and will be continued as far as time permits. A study of the burrowing habits of the pecan trunk borer has been made and the life history partly determined. Although common, this is not a serious pest to control.

#### COLLECTIONS.

A collection of South Carolina insects has been begun. The specimens are mounted in a large case fitted with Cornell drawers. This work will be continued and lists with records of distribution and injury will be presented for publication during the coming year.

#### CORRESPONDENCE.

The correspondence of this Division has been much lighter than it should be. There is a continual increase at the present time, owing to the arrival of the crop season. The correspondence work has been organized in a manner that inquiries can be answered promptly and at the same time all records filed in such a way so as to make them easily accessible by almost any conceivable means of cross reference. The system consists of correspondence cards, accession cards, food catalog and species catalog. To this will be added distribution maps, which will enable us to keep a record of the distribution and injuries by various insects from year to year.

#### PUBLICATIONS.

Besides seven newspaper articles this Division has issued two bulletins during the past year, viz., Bulletin 134, San Jose Scale, and Bulletin 137, Hook Worm Disease in Cattle. The latter bulletin was issued jointly with the Division of Veterinary Science.

#### WORK PROPOSED FOR THE COMING YEAR.

I recommend that the work for the coming year will be a continuation of the work now in progress. Our chief attention will be directed to a study of the strongyloid parasites in the digestive tract of ruminants. This investigation is at present prosecuted vigorously, and the economic results will be published next fall as a continuation of the preliminary investigations already recorded in Bulletin 137 of this Station. There is considerable technical work accumulating in connection with this investigation which could not be published to advantage in a farmers' bulletin, but which could be



presented from this Station in a technical bulletin in a smaller issue.

It is the aim of this Division to prosecute one single investigation, giving it all the attention it requires, and utilizing odd moments in carrying on such phases of the other investigations suggested as far as possible.

While this report is being written arrangements are under way for cooperative work with the U. S. Department of Agriculture. An investigator of the Bureau of Entomology is stationed at this laboratory cooperating with this Division in the investigation of insects injurious to cereal and forage crops. At the present time the Southern grain louse is receiving the principal attention. While this insect is one of the most serious pests in Southern agriculture we have no records of any work done with it in South Carolina. Furthermore, owing to the total absence of records, there is an endless amount of work to be done in this State, even on the more common insects. Cooperative work with the Department of Agriculture on South Carolina insects if carried on judiciously is, therefore, desirable, especially when considering the small working force in this Division at the present time.

Thanking you for your interest and courteous support, I am

Respectfully yours,

A. F. CONRADI,  
Zoologist and Entomologist.



## REPORT OF SECRETARY AND LIBRARIAN.

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Clemson College, S. C., November 25, 1908.  
 Prof. J. N. Harper, Director, South Carolina Experiment Station.

Dear Sir: Responding to your request, I beg to submit the following report of a part of the work performed in the office of the Secretary and Librarian of the South Carolina Experiment Station, for the period of the fiscal year, beginning July 1, 1907, and closing June 30, 1908:

The activity and success of this office in bringing the results of the Station's work before the agricultural public continue unabated as the work becomes more important and more necessary to the welfare of the farmers of the State. Nothing so readily gives practical value and general importance to Experiment Station work as an extended dissemination of the reports of its progress and accomplishment, in the solution of agricultural problems.

The remarkable success, which has attended the wide distribution of our publications throughout the State, and even into the regions beyond, is clearly to be seen in the employment by our farmers of better methods for cultivating, fertilizing, harvesting and marketing their crops,—in the more reasonable provision for the caring and feeding of farm animals, and in the more successful application of remedies for diseases of plants and animals.

This Experiment Station has issued during the past year nine bulletins and one annual report. These contain in the aggregate 268 pages. Besides the analyses of commercial fertilizers, these bulletins represent intelligent discussions on quite a variety of interesting subjects, such as: "Rotundifolia Grapes," "Report of Coast Land Experiments," "The San Jose Scale," "The Williamson Plan in 1907," "The Manufacture of Starch from Sweet Potatoes," "Hook Worm Disease of Cattle," "Milk Fever—Its Prevention and Successful Treatment," and "Some Conditions Influencing Cotton Production."

The work of distributing the analyses of commercial fertilizers among the farmers of this State was begun in the month of January. A leaflet of four pages containing the analyses was published at the College and mailed from this office once a week for twenty-two weeks in editions of 14,000 copies. These leaflets were distributed with weekly regularity upon as many farms in the State. The pur-



pose of this wide diffusion of the records of the chemical analyses was the protection of the farmer against the purchase of fraudulent fertilizers.

The total number of bulletins issued from this Station during the past fiscal year, including the fertilizer leaflets, amounted to 404,000 copies.

A striking evidence of a growing interest in all matters pertaining to the publications of this Station is seen in a statement of the fact that we have made accessions of 1,600 names on the permanent mailing list, within the past year.

Respectfully submitted,

JOHN N. HOOK,  
Secretary and Librarian.